I claim:

1. An Adaptive Generalized Matched Filter (AGMF) rake receiver system, comprising:

a rake receiver coupled to a spread spectrum input signal that applies a vector of weight

signals ($\bar{w}$) to the spread spectrum input signal to compensate for dependant noise and generates

a decision variable; and

an AGMF weight determination module that monitors the decision variable and generates

the vector of weight signals ($\bar{w}$), wherein optimal values for the vector of weight signals ($\bar{w}$)

are calculated by the AGMF weight determination module by varying the vector of weight

signals ($\bar{w}$) until the signal-to-noise ratio of the decision variable reaches a peak value.

2. The AGMF rake receiver system of claim 1, wherein the AGMF weight determination

module is one or more software modules operating on a processing unit.

3. The AGMF rake receiver system of claim 1, further comprising:

a decoder coupled to the decision variable that generates a binary output.

4. The AGMF rake receiver system of claim 1, wherein the spread spectrum input signal is a

Code Division Multiple Access (CDMA) signal.

5. The AGMF rake receiver system of claim 4, further comprising:

a CDMA processing module coupled to the spread spectrum input signal that tracks a

pilot channel in the spread spectrum input signal and generates a vector of delay elements ($\bar{d}$)

that are coupled to the rake receiver, wherein the rake receiver uses the vector of delay elements

$(\bar{\mathbf{d}})$ to despread a plurality of multi-path clusters of the spread spectrum input signal.

6. The AGMF rake receiver system of claim 5, wherein the CDMA processing module is one or more software modules operating on a processing unit.

7. The AGMF rake receiver system of claim 5, wherein:

the vector of delay elements $(\bar{\mathbf{d}})$ is also coupled to the AGMF weight determination module;

the CDMA processing module also generates a vector of channel impulse response signals $(\bar{\mathbf{h}})$ that are coupled to the AGMF weight determination module; and

the vector of channel impulse response signals $(\bar{\mathbf{h}})$, the vector of delay elements $(\bar{\mathbf{d}})$ and the signal-to-noise ratio of the decision variable are used by the AGMF weight determination module to calculate a total noise covariance matrix $(\mathbf{R}_u)$, and wherein the vector of weight signals $(\bar{\mathbf{w}})$ is calculated using the equation $\bar{\mathbf{w}} = \mathbf{R}_u^{-1}\bar{\mathbf{h}}$.

8. The AGMF rake receiver system of claim 7, wherein the total noise covariance matrix $(\mathbf{R}_u)$ has an independent noise component and a dependent noise component.

9. The AGMF rake receiver system of claim 8, wherein the independent noise component of the total noise covariance matrix $(\mathbf{R}_u)$ is stored in a memory device and retrieved by the AGMF weight determination module.

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10. The AGMF rake receiver system of claim 8, wherein the dependent noise component of the total noise covariance matrix ($\bar{\mathbf{R}}_u$) is calculated by the AGMF weight determination module using the vector of delay elements ($\bar{\mathbf{d}}$) and the vector of channel impulse response signals ($\bar{\mathbf{h}}$).

11. The AGMF rake receiver system of claim 8, wherein the independent noise component is an independent noise covariance matrix ($\mathbf{R}_{IND}$) and the dependent noise component is a dependent noise covariance matrix ($\mathbf{R}_{DEP}$) and the total noise covariance matrix is calculated using the formula $\mathbf{R}_u = r_o \mathbf{R}_{MUI} + (1 - r_o) \mathbf{R}_{IAN}$, wherein the value of r_0 is varied between $0 \le r_0 \le 1$ by the AGMF weight determination module in order to vary the vector of weight signals ($\bar{\mathbf{w}}$) until the signal-to-noise ratio of the decision variable reaches a peak value.

12. The AGMF rake receiver system of claim 11, wherein the value of r_0 represented by a plurality of discrete states.

13. The AGMF rake receiver system of claim 1, wherein the rake receiver comprises:

a plurality of correlator fingers that receive the spread spectrum input signal and apply a despreading signal to generate a plurality of correlation output signals;

a plurality of weight multipliers, each of which is coupled to one correlation output signal and one weight signal from the vector of weight signals ($\bar{\mathbf{w}}$) and generates a weight multiplier output; and

an adder coupled to the weight multiplier outputs from the plurality of weight multipliers that combines the weight multiplier outputs to generate the decision variable.

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14. The AGMF rake receiver system of claim 1, wherein the AGMF weight determination module monitors two consecutive states of the decision variable in order to determine when the signal-to-noise ratio of the decision variable is at the peak value.

15. The AGMF rake receiver system of claim 14, wherein the AGMF weight determination module simultaneously generates a first and a second vector of weight signals, each vector of weight signals corresponding to one of the two consecutive states of the decision variable, and wherein the rake receiver comprises:

    a plurality of correlator fingers that receive the spread spectrum input signal and apply a despreading signal to generate a plurality of correlation output signals;

    a first output stage that applies the first vector of weight signals to the plurality of correlation output signals and generates a first state of the decision variable; and

    a second output stage that applies the second vector of weight signals to the plurality of correlation output signals and generates a second state of the decision variable.

16. The AGMF rake receiver system of claim 15, wherein:

    the first output stage comprises:

        a first plurality of weight multipliers, each of which is coupled to one weight signal from the first vector of weight signals and generates a first weight multiplier output, and

        a first adder coupled to the first weight multiplier outputs from the first plurality of weight multipliers that combines the first weight multiplier outputs to generate the first state of the decision variable; and

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the second output stage comprises:

a second plurality of weight multipliers, each of which is coupled to one weight signal from the second vector of weight signals and generates a second weight multiplier output, and

a second adder coupled to the second weight multiplier outputs from the second plurality of weight multipliers that combines the second weight multiplier outputs to generate the second state of the decision variable.

17. An Adaptive Generalized Matched Filter (AGMF) rake receiver system, comprising:

a plurality of correlator fingers that receive a spread spectrum input signal and apply a despreading signal to generate a plurality of correlation output signals;

a plurality of weight multipliers, each of which is coupled to one correlation output signal and one of a plurality of weight signals and generates a weight multiplier output; and

an adder coupled to the weight multiplier outputs from the plurality of weight multipliers that combines the weight multiplier outputs to generate a decision variable;

wherein the plurality of weight signals are derived by monitoring the decision variable in order to optimize the signal-to-noise ratio of the decision variable.

18. The AGMF rake receiver system of claim 17, wherein a delay element is applied to the spread spectrum input signal in each of the plurality of correlator fingers in order to align the despreading signal with one multi-path cluster of the spread spectrum input signal.

19. The AGMF rake receiver system of claim 18, wherein each correlator finger includes an integrator that correlates the spread spectrum input signal over a period of time.

20. The AGMF rake receiver system of claim 17, further comprising:

an additional plurality of weight multipliers, each of which is coupled to one correlation output signal and one of a plurality of additional weight signals and generates an additional weight multiplier output; and

an additional adder coupled to the additional weight multiplier outputs from the plurality of additional weight multipliers that combines the additional weight multiplier outputs to generate an additional decision variable;

wherein the plurality of additional weight signals are derived by monitoring the additional decision variable, and wherein the signal-to-noise ratio of the decision variable is optimized by comparing the decision variable with the additional decision variable in order to detect a peak value for the signal-to-noise ratio.

21. A method of optimizing a signal-to-noise ratio in a decision variable output of an Adaptive Generalized Matched Filter (AGMF) rake receiver system, comprising the steps of:

providing a rake receiver that applies a vector of weight signals ($\bar{w}$) to a spread spectrum input signal to compensate for multi-user interference and generates a decision variable output;

providing a CDMA processing module that monitors the decision variable output and generates the vector of weight signals as a function of a scalar parameter (r_o);

setting the scalar parameter to a first value;

generating the vector of weight signals ($\bar{w}$) using the first scalar parameter value;

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calculating a first signal-to-noise ratio of the decision variable output;

setting the scalar parameter to a second value;

generating the vector of weight signals ($\bar{w}$) using the second scalar parameter value;

calculating a second signal-to-noise ratio of the decision variable output; and

if the second signal-to-noise ratio is greater than the first signal-to-noise ratio, then

setting the first scalar parameter value to the second scalar parameter value.

22. A method of determining a vector of weight signals ($\bar{w}$) for optimizing a spread spectrum

signal rake receiver in a mobile communication device, comprising the steps of:

receiving a spread spectrum signal;

determining a vector of channel impulse response signals ($\bar{h}$) from the spread spectrum

signal;

providing an independent noise covariance matrix (R_{IND}) stored in a memory location on

the mobile communication device;

monitoring the vector of channel impulse response signals ($\bar{h}$) to determine a dependent

noise covariance matrix (R_{DEP});

determining a total noise covariance matrix ($\bar{R}_u$) as a function of the independent noise

covariance matrix (R_{IND}), the dependent noise covariance matrix (R_{DEP}) and a scalar parameter

(r_o); and

determining the vector of weight signals ($\bar{w}$) from the total noise covariance matrix ($\bar{R}_u$)

and the vector of channel impulse response signals ($\bar{h}$).

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23. The method of claim 22, wherein the total noise covariance matrix ($\bar{\mathbf{R}}_u$) is calculated using the equation $\mathbf{R}_u = r_o \mathbf{R}_{DEP} + (1 - r_o)\mathbf{R}_{IND}$.

24. The method of claim 22, wherein the vector of weight signals ($\bar{\mathbf{w}}$) is calculated using the equation $\bar{\mathbf{w}} = \mathbf{R}_u^{-1}\bar{\mathbf{h}}$.

25. The method of claim 22, wherein the scalar parameter (r_o) is calculated as a function of a feedback signal from the spread spectrum signal rake receiver.

26. The method of claim 25, wherein the feedback signal is the signal to noise ratio of a decision variable output from the spread spectrum signal rake receiver.

27. The method of claim 25, wherein the feedback signal is a bit error rate of a decision variable output from the spread spectrum signal rake receiver.

28. The method of claim 22, wherein the scalar parameter (r_o) is in the range $0 \leq r_o \leq 1$.

29. The method of claim 22, wherein the scalar parameter (r_o) is calculated using a one dimensional search algorithm that identifies an optimal value for the feedback signal from the spread spectrum signal rake receiver.